FINAL REPORT

Contract DACA90-80-C-0083
Energy Engineering Analysis Program in Europe
Vicenza Military Community

Volume I
Executive Summary

prepared by

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Revised 20 May 1983

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17 Sep 1987

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EXECUTIVE SUMMARY

I. INTRODUCTION

A. General

1. This IEAP study was performed on the two major installations on USMCA Vicenza, Italy: Camp Ederle and Villaggio.

2. It analyzes the energy consumption patterns of calendar year 1980 and evaluates the energy conservation program established for 1981.

3. The field work commenced in January 1981 and was completed in August of that year.

4. The analysis made extensive use of BLAST (Building Loads And System Thermodynamics).

5. New policies for determining heating plant efficiency are recommended.

6. No new funded projects have been developed.

B. Results

1. Recommended actions will save 37.9 x 10^9 Btu/yr worth $192,000 in 1980, halt a contemplated $5 million investment in a co-generation project, and save an additional $138,000 per year financial losses incidental to the $5 million.

2. Energy consumption has fallen 21% in the study area since 1975.

3. 1985 energy consumption will be 26% less than 1975 levels.

II. ENERGY CONSUMPTION

A. Past, Present, and Future

1. The study areas had a reported FY 1975 energy consumption of 285.5 x 10^9 Btus.

2. During the period analyzed in this report--calendar year 1980--records indicate a consumption of 226.5 x 10^9 Btus, 21% less than the 1975 baseline.

3. Formidable curtailments and voluntary but strict compliance with the Italian heating restrictions will have lowered consumption further during 1981, but these practices are not expected to continue.

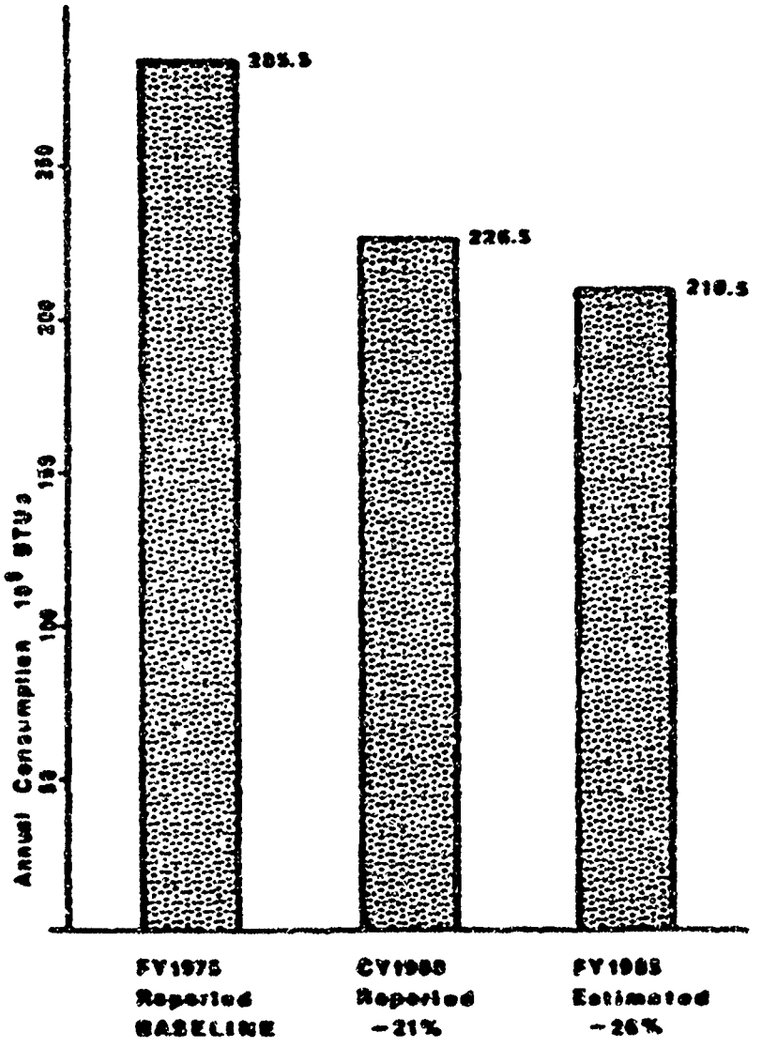

FIGURE 4.1
PAST AND FUTURE
ENERGY CONSUMPTION
USMCA-VICENZA

4. If all planned community projects, including the insulation projects, are completed, estimated FY 1985 consumption will be 186.8×10^9 Btu. If insulation projects are dropped, estimated FY 1985 consumption will be approximately 210.5×10^9 Btu, 26% less than the 1975 baseline. Figure I.1 illustrates this historical progression in yearly consumption.

B. Energy Use Patterns

1. The distribution of energy among its various uses was analyzed using BLAST (Building Loads and System Thermodynamics). This distribution is summarized in Tables I and II below.

TABLE I

DISTRIBUTION OF 1980 VICENZA ENERGY USE

(both Ederle and Villaggio)

USE	10^9 Btu	%
Space Heating	104.4	46.1
Distribution System Losses	5.0	2.2
Domestic Hot Water	6.6	2.9
Heating Plant Losses	60.9	26.9
Building Electrical	17.1	7.5
Air Conditioning	14.8	6.5
Heating Plant Electrical	4.9	2.2
Perimeter and Street Lighting	1.1	.5
Electrical System Losses	.7	.3
L.P. Gas (cooking)	11.0	4.9
	226.5	100.0

TABLE II

ESTIMATED DISTRIBUTION OF 1983 VICENZA ENERGY USE

(both Ederle and Villaggio)

USE	10^9 Btu	%
Space Heating	94.0	44.7
Distribution System Losses	5.0	2.4
Domestic Hot Water	6.6	3.1
Heating Plant Losses	55.5	26.4
Building Electrical	17.1	8.1
Air Conditioning	14.8	7.0
Heating Plant Electrical	4.9	2.3
Perimeter and Street Lighting	1.1	.5
Electrical System Losses	.7	.3
L.P. Gas (cooking)	11.0	5.2
	210.5	100.0

2. The distribution of energy by sources is given in Table III below.

TABLE III

ENERGY CONSUMPTION BY SOURCE, CY 1980

USNCA VICENZA

Source	Amount	Energy	Cost
Electric Energy	11.8 x 10^6 kWhr	40.2 x 10^9 Btu	$489,100
Electric Demand	---	---	82,500
#5 Fuel Oil	1,327,700 gallons	198 x 10^9 Btu	861,400
LP Gas	437,400 liters	11.5 x 10^9 Btu	82,235
		249.7 x 10^9 Btu	$1,515,235

3. A picture of the energy flow on each installation is shown on the Input-Output diagrams in Volume II.

C. Typical Building Energy Consumption

1. All the buildings in the study area were assigned to one of nine building types. Descriptions and energy parameters for each of these types can be found in Volume III.

2. "Average" buildings of each type were constructed from audit data using hand calculating techniques. The year-round energy consumption characteristics of each "average" building was ascertained using annual BLAST.

D. Heating Plant Consumption

1. The calculated monthly consumption for the two Vicenza heating plants are given below.

MONTHLY CONSUMPTION, EDERLE 206

Month	Input (10^9 Btu)	Output (10^9 Btu)	Efficiency
Jan	24.3	16.4	.677
Feb	15.7	10.3	.654
Mar	15.7	10.3	.653
Apr	6.6	3.9	.588
May	3.6	1.9	.519
Jun	.7	.3	.469
Jul	.7	.3	.469
Aug	.7	.3	.469
Sep	2.4	1.2	.504
Oct	5.8	3.4	.579
Nov	13.3	8.5	.641
Dec	19.7	13.1	.667

MONTHLY CONSUMPTION, VILLAGGIO 301

Month	Input (10^9 Btu)	Output (10^9 Btu)	Efficiency
Jan	19.2	12.8	.669
Feb	13.4	8.6	.646
Mar	13.1	8.5	.648
Apr	4.5	2.7	.588
May	.8	.2	.301
Jun	.8	.2	.301
Jul	.8	.2	.301
Aug	.8	.2	.301
Sep	.8	.2	.301
Oct	4.4	2.5	.561
Nov	11.8	7.5	.636
Dec	16.7	10.7	.641

III. ENERGY CONSERVATION OPPORTUNITIES ASSESSED

A. Community Projects

1. ECIP parameters were calculated for the funded projects in the Vicenza Community Energy Conservation Plan. These are shown below.

ECIP PARAMETERS OF COMMUNITY PROJECTS

Project		Cost 10^3	Savings 10^6 Btu	Benefit 10^3	B/C	E/C	Payback Years
II.1.d	Summer HX	17	26	.78	.05	1.5	142*
II.1.e	Summer HX	17	40	1.2	.07	2.4	91*
II.1.g	Solar for 210	10	15	.5	.05	1.5	143
II.1.i	commis. cases	281	48	1.4	-	.17	1,405
II.1.l	bowling alley doors	40	1	.03	-	.03	10,000
II.1.m	repair bldg 102	65	1	.03	-	.02	16,250
II.1.n	fix bldgs 6 & 7	561	800	24.4	.04	1.4	150
II.1.o	fix bldg 308	195	5	.15	-	.03	3,480
II.1.p	wash rack	55	1	.03	-	.02	11,730
II.1.q	repair heating syst.	142	1,500	45.7	.32	10.6	20

* As assessed by the study team.

Project		Cost 10^3	Savings 10^6 Btu	Benefit 10^3	B/C	E/C	Payback Years
II.1.r	Aluminum roofs	55	3	.09	-	.05	3,930
II.1.s	double door bldg 3	3	1	.03	.01	.33	640
II.1.t	new doors, school	50	2	.06	-	.04	21,320
II.1.u	fix bldg 106	160	95	2.9	.02	.59	353
II.1.v	fix bldg 107	132	90	2.7	.02	.68	312
II.1.w	power factor	23	90	2.6	.11	9.9	57
II.1.x	replace tank	10	1	.03	-	.1	2,130
II.1.y	rewire NCO club	15	2	.06	-	.13	1,670
II.2.a	fix bldg 4	360	400	12.2	.03	1.1	193
II.2.b	fix bldg 100	200	90	2.7	.01	.45	47
II.2.c	fix bldg 311	45	2	.06	-	.04	4,800
II.2.d	fix hosp. windows	350	200	6.1	.02	.57	373
II.2.e	new compr.	45	5	.15	-	.11	2,000
II.2.f	walk-in frzr	30	6	.17	-	.20	1,111
II.2.g	new street lights	86	12	.35	-	.14	1,590
II.2.h	repair heating syst.	86	1,800	54	.63	21	10
II.2.i	fix bldg 5	360	400	12	.03	1.1	192
II.2.j	fix bldg 101	200	90	2.7	.01	.45	473
II.2.k	rewire bldg 302	75	1	.03	-	.01	16,700
II.2.l	exhaust hoods	45	1	.03	-	.02	10,000
II.2.m	rewire hospital	260	2	.06	-	-	28,900
II.2.n	renovate bakery	100	100	3.0	.03	1.0	213
II.2.o	fix bldg 1	300	300	9.0	.03	1.0	213
II.2.p	fix bldg 1, 2, & 3	190	500	15	.08	.08	81
II.2.q	fix bldg 8	360	400	12	.03	1.1	192
II.2.r	fix bldg 104	200	90	2.7	.01	.45	474
II.2.s	insulate 6 bldgs	300	500	15	.05	1.7	128
II.2.t	fix bldg 2	250	250	7.6	.03	1.0	213
II.2.u	fix bldg 3	250	250	7.6	.03	1.0	213
II.2.v	rewire 40 bldgs	186	1	.03	-	-	41,300
II.2.w	fix connections	150	1	.03	-	-	33,300
II.2.x	city gas	300	400	19	.06	1.3	100
II.2.y	carpeting	25	1	.03	-	.04	5,330
II.2.z	new windows	87	5	.15	-	.06	3,500
II.2.aa	new AHU	180	2	.06	-	.01	20,000
II.2.bb	fix bldg 9	360	400	12	.03	1.1	192
II.2.cc	fix bldg 105	200	90	2.7	01	.45	474
II.2.dd	fix bldgs 102, 109	120	70	2.1	.02	.58	366

Project		Cost 10^3	Savings 10^6 Btu	Benefit 10^3	B/C	E/C	Payback Years
II.2.ee	fix bldgs 300, 301	120	70	2.1	.02	.58	366
II.2.ff	fix chapel	115	40	1.2	.01	.35	613
III.a	district heat	6,000	80,000	2,340	.39	13	17
III.b	new boilers	120	2,000	61	.51	17	13
III.c	insulate Villaggio	3,000	10,000	305	.10	3.3	64
III.d	hot water system	455	450	14	.03	1	216*
III.e	weather guard	3,200	0	0	-	-	- *
III.f	Ederle solar	1,000	3,710	113	.11	.37	57*
III.g	Villaggio solar	400	1,485	45	.11	.37	57*
III.h	rewire 20 bldgs	160	234	6.8	.04	1.5	152
III.i	rewire bldg 200	50	2	.06	-	.04	5,560
III.j	repair switchgear	10	10	.29	.03	1.0	222
III.k	weather guard	455	0	0	-	-	- *
III.l	repair roofs	212	120	3.6	.02	.37	377
III.m	repair roofs	232	120	3.6	.02	.52	412
III.n	city gas	400	3	.15	-	-	17,900
III.o	fix doors	204	5	.15	-	.02	8,700
III.p	insulate roofs	232	120	3.7	.02	.52	412
III.q	new windows	74	80	2.4	.03	1.1	197
III.r	fix doors	235	5	.15	-	.02	10,000
III.s	new valves	9	1	.03	-	.11	1,920

* As assessed by the study team.

2. Additional Measures Assessed

1. The possible use of coal as a boiler fuel for Vicenza.
2. A load shedding system for Caserma Ederle.
3. Electric meters for tenant units.
4. #2 oil burning summer hot water heaters for Ederle and Villaggio.
5. Generalized solar hot water heating.
6. EMCS.
7. Double roofs for family houses to reduce summer heat gain.

IV. PROJECTS

1. We have no projects to add to Vicenza's existing program.

V. RECOMMENDED ENERGY MANAGEMENT PLAN

1. The effectiveness of Vicenza's existing energy management activities is attested to by the 21% reduction achieved by the community before the study began and by their performance on recent USAREUR energy conservation competitions.

2. The Vicenza FE department has been restaffed and reorganized since the close of the study in January 1982. However, those recommendations designed to increase the department's ability to review and administer projects prepared by A-E firms, as well as those meant to decrease its relative isolation, should be considered. Master planning should give considerable weight to energy conservation from consolidation of planned construction.

3. Vicenza has a higher proportion of social, athletic, and dependent support activities than other communities encountered by the study team (Livorno in Italy and Karlsruhe in Germany). Cutbacks in these areas, such as no after-dark athletics, no air conditioning in theaters, clubs, and libraries, and similar actions, are possible and well-known to the community command. We have taken no position concerning such steps.

4. Concerning the community's energy savings projects, funded projects dealing with insulating existing buildings, wholesale replacement of doors and windows, and building or distribution system rewiring should be de-emphasized unless required for non-energy-related reasons. No more solar hot water projects should be planned. EMCS should not be installed.

5. Boiler efficiency tests based on stack gas should be instituted.

6. Both active and passive solar devices and other passive energy conservation features should be incorporated into the designs of all future construction.

VI. OTHER STUDY RESULTS

1. Additional investigations of several topics were required to faithfully analyze the energy conservation and economic characteristics of the Vicenza community. These additional topics included predicting Italian prices into the next decade, and using the BLAST computer program to model typical military bases.

2. The course of future prices in Italy was forecast using information published by the Department of Energy and from an econometric model of the world economy developed by the University of Pennsylvania and the University of Bologna, among others. These projections are described in Appendix F-1.

3. A BLAST model of Camp Ederle and Villaggio della Pace based on nine average building types was used to determine the paths followed by funds and fuels consumed on Vicenza through to their final loss to the environment as waste heat.